Predicting the Need for Extrication in Traffic Accidents Reported to 911: Is Anyone Pinned/Trapped?

Chris Davis, EMD-I[1]; Paige Dodson, MD, MPH, FAAFP[2]; Chad Pore, MS, Paramedic[2]; Sirilakshmi Sangaraju, MS[3]; Meghan Broadbent, MS[3]; Greg Scott, MBA, EMD-Q-I[3]; Isabel Gardett, PhD[3]; Christopher Olola, PhD[3]

IAED RESEARCH WORKSHOP STUDY

1. Butler County Emergency Communications Center, El Dorado, KS, USA.
2. Butler County Emergency Medical Services, El Dorado, KS, USA.
3. International Academies of Emergency Dispatch, Salt Lake City, Utah, USA.

Corresponding Author
Chris Davis
121 S Gordy El Dorado,
KS 67042, USA
Phone: 316-322-4398
Fax: 316-322-4206
Email: cdavis@bucoks.com

Keywords
Extrication, SEMI, Head-on, Mechanism of injury, Motor vehicle accidents, MVA, Traffic accidents

Citation
Davis C, Dodson P, Pore C, Sangaraju S, Broadbent M, Scott G, Gardett I, Olola C. Predicting the need for extrication in traffic accidents reported to 911: is anyone pinned/trapped? *Ann Emerg Dispatch & Response*. 2018;6(3):5-9.

ABSTRACT

Introduction: Extrication activities at the scene of motor vehicle accidents (MVA) result in extended scene times and increase morbidity and mortality. Identifying the need for extrication-capable resources during the 911 call-taking process, and dispatching them without delay, is crucial to delivering the required response and patient care. Determining the need for extrication using the Traffic/Transport Incidents Protocol in the Medical Priority Dispatch System (MPDS®) (version 13.0 ©2000-2015, Priority Dispatch, Salt Lake City, Utah, USA) currently relies on the 911 caller's answer to a single key question in the protocol: "Is anyone pinned (trapped)?"
Objectives: The aim of this study was to evaluate how accurate current 911 practices are in recognizing pins and entrapments resulting from MVAs. Additionally, the study sought to identify whether a Head-On (HO) MVA or an MVA with Semi-Tractor Trailer (Semi) involvement should warrant the immediate assignment of specialized extrication resources.
Methods: This was a retrospective descriptive study of all MVA cases in three Kansas counties (Butler, Sedgwick, and Johnson), encountered from January 1, 2016, through June 30, 2017. 911 calltakers in the study population utilize the MPDS Protocols to triage MVA calls. Traffic accident data was extracted from ProQA and matched with CAD records.
Results: A total of 985 calls were analyzed, of which 218 (22.1%) required extrication and 267 (27.1%) involved Semi/HO—as documented by responders. Of the 218 cases that required extrication, 123 (56.4%) were reported pinned at dispatch and 21 (9.6%) involved Semi/head-on—15 of which were already captured by the pinned Key Question. Of the 267 cases that involved a Semi/HO, 21 (7.9%) required extrication. Of the cases that were initially reported pinned at dispatch, 123 (32.3%) required extrication by responders; and of the cases initially reported not pinned at dispatch, 59 (11.4%) required extrication by responders.
Conclusions: A "yes" answer to the protocol key question "Is anyone pinned (trapped)?" is a better predictor of extrication by responders for MVAs than is the presence of Semi/head-on involvement. Further research should examine whether High Mechanism and Major Incident determinant suffixes will capture additional extrication incidents.

INTRODUCTION

According to the National Safety Council, in 2017, nearly "4.57 million people were injured seriously enough to require medical attention in motor vehicle crashes", and over 40,000 lives were lost.[1] One goal of any prehospital healthcare system is to decrease the morbidity and mortality (M&M) associated with motor vehicle accidents (MVAs). The prompt provision of emergency care and rapid movement of injured victims from the scene of injury to an acute-care facility—often a designated trauma center—can save lives, reduce the incidence of short-term disability, and dramatically improve long-term outcomes.[2, 3]

To this end, in 2011 the Center for Disease Control (CDC) released updated Guidelines for Field Triage of Injured Patients.[4] These guidelines provide a roadmap for Emergency Medical Service (EMS) providers to assist in identifying Trauma Center Need (TCN). Prolonged extrication is a major limiting factor inhibiting quick transfer from the scene to a trauma center. A report by Isenberg et al.[5] suggests that refining the

CDC Guidelines for Field Triage of Injured Patients by replacing the vehicle intrusion criterion with an entrapment criterion would improve the guidelines' ability to predict TCN. Stuke et al.[6] similarly reported the finding that inclusion of extrication time greater than 20 minutes was a positive predictor of TCN.

Since the need for vehicle extrication services alone is a predictor of fatality and severity of injuries,[7] identifying the need for vehicle extrication services early in the event is a must in the pursuit to decrease M&M associated with motor vehicle accidents. While the CDC guidelines assist EMS in TCN determination once on scene, they do not assist in identifying the need for specialized vehicle extrication resources. In many areas, extrication capable units are not automatically dispatched to every injury MVA, but instead these limited resources are assigned only when evidence of pins or entrapments are present. A key opportunity available to help identify this need occurs in the 911 calltaking process. The Medical Priority Dispatch System (MPDS®) requires the Emergency Medical Dispatcher (EMD) in Protocol 29: Traffic/Transportation Incidents (P29) to ask the key question, "Is anyone pinned (trapped)." Determining the presence of pinned (trapped) patients in the 911 center is a crucial factor in rapid response of these specialized resources.

Emergency Communication Centers (ECCs) have been traditionally overlooked as having an integral role in the decrease of M&M for vehicle accidents. Yet the ECC's role in assigning the correct emergency resources can be pivotal, particularly when extrication need can be predicted with reasonable confidence.

OBJECTIVES

The objective of this study was to evaluate how accurate current 911 practices are in recognizing pins and entrapments resulting from MVAs. Additionally, the study sought to identify whether a Head-On (HO) MVA or an MVA with Semi-Tractor Trailer (Semi) involvement should warrant the immediate assignment of specialized extrication resources.

METHODS

Design and Settings

This was a descriptive study designed to retrospectively analyze all MVA cases in three Kansas counties: Butler, Sedgwick, and Johnson. The data was extracted from cases encountered from January 1, 2016 to June 30, 2017. The 911 calltakers/EMDs in these jurisdictions utilized the MPDS® Protocols to triage calls.

Butler County Emergency Communications Center

Established in 1995, the Butler County Emergency Communications Center (ECC) is the primary answering point (PSAP) for 18 emergency response departments throughout Butler County. It dispatches more than 50,000 calls for service each year. The ECC also shares these responsibilities with neighboring centers to serve five fire departments whose districts cross 911 boundaries.

Sedgwick County Emergency Communications

Sedgwick County was founded in 1867. Since then, it has expanded to include 20 cities, including county seat Wichita—the largest city in Kansas—and the county has a population of over 500,000.

Johnson County Emergency Communications Center

Johnson County ECC is a secondary Public Safety Answering Point (PSAP) that dispatches for the ALS ambulance service and ten fire departments. Johnson County has an approximate population of 500,000 residents and covers approximately 500 square miles. Johnson County processes about 40,000 medical calls per year.

Study population

The study population included all cases where extrication was used on the scene of the emergency, and all the cases that were handled using the Traffic/Transportation Incidents Chief Complaint Protocol (29) and recorded as pinned(trapped) victims (29-D-5 determinant code). The study sample also included all cases that were recorded in the Computer-Aided Dispatch (CAD) system as having involved either a Semi-Tractor trailer or a head-on collision.

Outcome measures

The outcome measures were the number of (a) cases that had a "yes" answer to the "pinned (trapped) Key Question in ProQA®, the software version of the MPDS, and extrication equipment actually used, as reported in the CAD record, (b) CAD cases where extrication equipment was used for an injury traffic accident involving a semi-tractor trailer or head-on collision, as reported in the CAD record.

Data analysis

R for statistical computing software (version 3.5.1, ©2018, R Foundation for Statistical Computing, Vienna, Austria) was used for data analysis. All the CAD and corresponding ProQA cases that involved traffic accidents were linked using the ProQA incident number. Using the matched cases, the extrication and Semi/HO involvement statuses, including the ProQA Key Question "Is anyone pinned (trapped)" answer responses, were presented using descriptive statistics such as frequencies and percentages.

RESULTS

A total of 168,101 ProQA and 3,268 CAD cases were collected, of which 985 calls met the study criteria. Of the 985 cases analyzed, 218 (22.1%) required extrication and 267 (27.1%) involved Semi/HO—as documented by responders (Fig. 1).

Overall, as recorded by the EMD, the "no" answer response to the "Is anyone pinned (trapped)?" KQ (n=516) was 88.6% of the time correct that no extrication was required (Fig. 2). Conversely, for the "yes" answer response to the KQ (n=381), 67.7% did not require extrication on scene.

Of the 218 cases that required extrication, 123 (56.4%) were reported "pinned" at dispatch (Fig. 3). However, among 767 cases

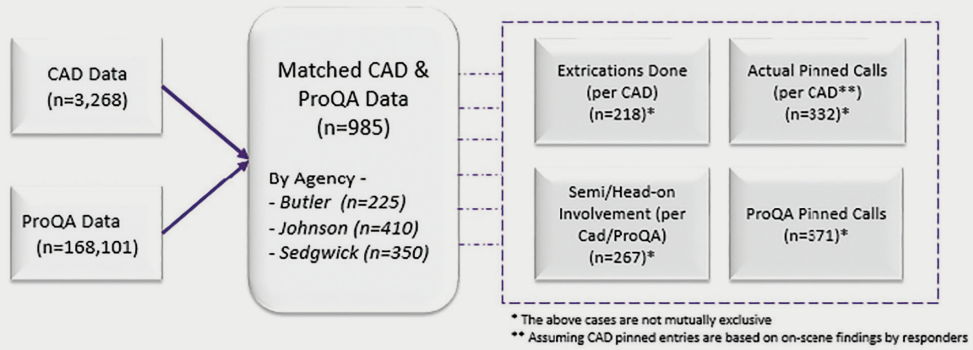

Figure 1. Study sample

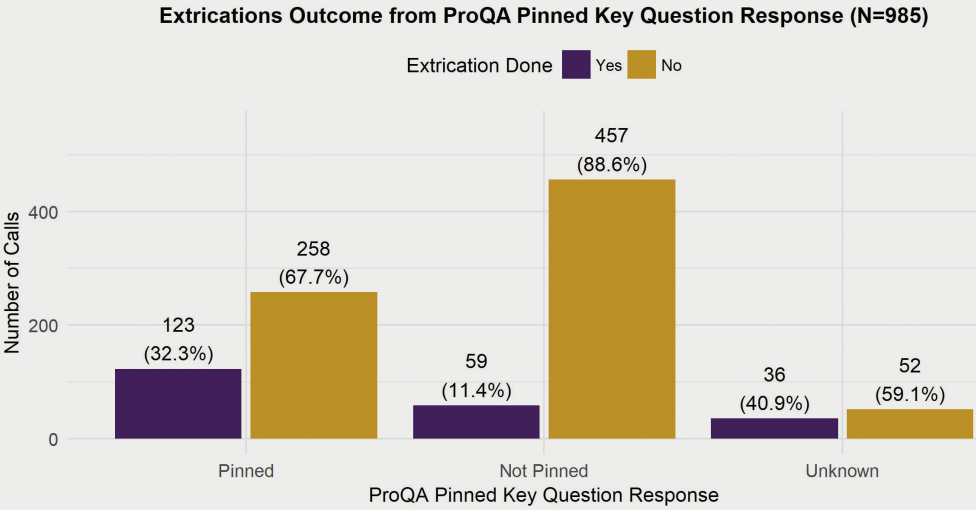

Figure 2. Extrication status of calls by ProQA Key Question answer responses

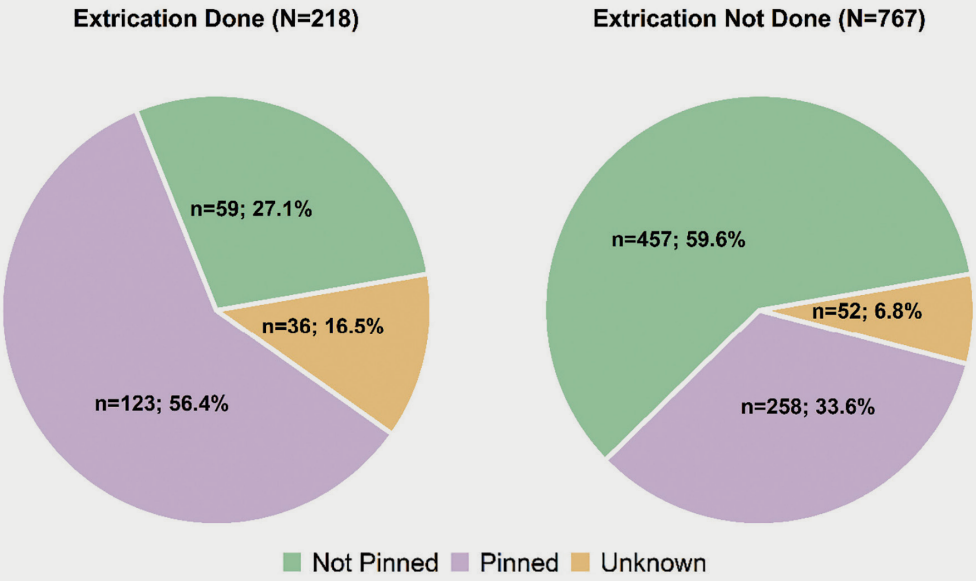

Figure 3. ProQA KQ answer responses categorized by extrication status of cases

where extrication was not done, a 59.6% majority were reported "not pinned" at dispatch.

Overall, of the 267 cases that involved a Semi/HO, only 21 (7.9%) required extrication—15 of which were already captured by the pinned Key Question (Fig. 4). However, of the 718 cases where a Semi/HO was not involved, 27.4% required extrication.

Of the 21 cases where a Semi/HO was involved and extrication was done, 71.4% were initially reported pinned at dispatch, compared to 54.8% among the 197 cases that did not involve a Semi/HO but required extrication (Table 1).

Additionally, of the 246 cases where a Semi/HO was involved but extrication was not required, only 6.5% were initially reported pinned at dispatch, compared to 46.3% among the 197 cases that neither involved a Semi/HO nor required extrication.

DISCUSSION

Several variables can impact the accuracy of information gathered during the 911 calltaking process, including the EMD's compliance to protocol and the reliability of the information provided by the caller. Further, 3rd-party callers who are not directly on scene may not have all the necessary information to accurately answer the Key Questions asked by the EMD.

On one hand, over half of all extrications were identified during the calltaking process, using the answer to a single Key Question as the identifier ("Is the patient pinned (trapped)?") This supports the practice of sending specialized vehicle extrication resources to the scene with the initial page, when this Key Question indicates pinned. On the other hand, when callers answer "yes," they are only right about three out of every ten times. In some systems, this may justify waiting until first responders arrive on scene and identify an extrication

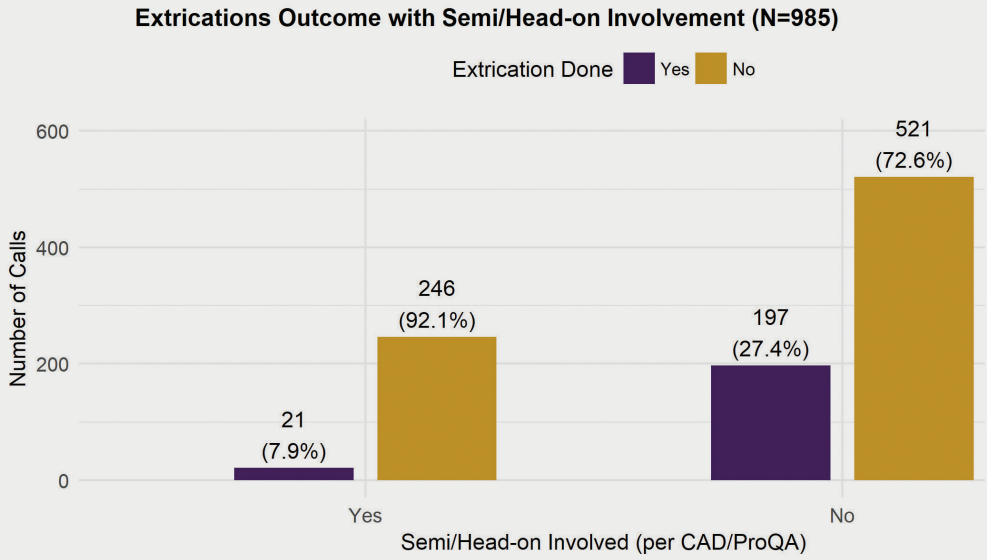

Figure 4. Extrication status of cases that involved a Semi/Head-on.

Extrication status	ProQA answer response	Semi/Head-on involved: n (%)	
		Yes (N=21)	No (N=197)
Yes	Not pinned	3 (14.3)	56 (28.4)
	Pinned	15 (71.4)	108 (54.8)
	Unknown	3 (14.3)	33 (16.8)
		Yes (N=246)	No (N=521)
No	Not pinned	230 (93.5)	260 (49.9)
	Pinned	16 (6.5)	241 (46.3)
	Unknown	0 (0.0)	20 (3.8)

Table 1. ProQA KQ answer responses categorized by Semi/head-on involvement and extrication statuses

need before dispatching specialized vehicle extrication resources. Local needs and resources, such as availability of rescue equipment, transport times, and crew fatigue, still need to be considered in determining a response plan for these cases.

It's also possible that some callers may correctly report a person pinned at the time of the call while on the phone with 911, to have the patient subsequently "escape" from this predicament, or be freed by bystanders before the first responder unit arrives.

Semi/Head-On

Currently, EMDs classify MVAs involving a Semi or HO collision with a determinant code of 29-D-3: Traffic Accident with HIGH VELOCITY Impact. Our findings suggest that this code is less accurate at predicting extrication, at least in the cases of Semi or HO.

MVAs with Semi or HO involvement appear on sight to be some of the worst MVAs in terms of intrusion and overall damage. Seeing this damage in person or through pictures persuades the viewer to believe these incidents have increased M&M rates. But vehicles today are built to a different standard than in years past. Crumple zones are integral to the safety of passengers, as they protect the passenger compartment. Visible damage to a vehicle often does not equate to severity of injuries to vehicle occupants.

The findings in this study involving MVAs with Semi or HO involvement supports the need to have the 911 caller look past the visible damage and answer the question "Is anyone pinned (trapped)?" These findings also suggest that the determinant code for "Pinned (trapped) victim" (29-D-5) may be more useful if moved up in the MPDS code hierarchy so that it is higher than 29-D-3 (HIGH VELOCITY impact), at least for pinned patients. Some other results of HIGH VELOCITY collisions may have greater impacts.

Unknown

When the EMD asks the 911 caller, "Is anyone pinned (trapped)" there are three possible answers: yes, no, and unknown. It is not common for the 911 caller to answer "unknown," as demonstrated by this study's results. Most often, when there is incomplete information, it's obtained from 3rd-party callers. These 3rd-party callers may continue driving past the scene, so they do not know if anyone is pinned. Current practices in many ECCs is to only recommend specialized vehicle extrication resources when the 911 caller provides an answer of "Yes", but not when the answer is "No" or "Unknown."

While the "unknown" answer selection was uncommon, it yielded a rather high percentage of cases where extrication was done. This is somewhat concerning, as specialized vehicle extrication resources are often not part of the initial dispatch, meaning they are not requested until an emergency responder arrives on scene and identifies the need for them. Further research is needed to determine if this result is reproducible, or if the small numbers of "unknowns" in this study resulted in a statistical anomaly.

Whether or not an agency chooses to send extrication resources with a response of "unknown" to the pinned question may depend on historical response time averages and the availability of specialty extrication/rescue vehicles and equipment.

Limitations

The biggest limitation was the lack of a defined way to document when extrication was performed in the EMS electronic patient care report (ePCR). The National EMS Information System (NEMSIS) does not currently define an element specific to extrication. Since extrication is not defined nationally, the

documentation of patients who are "pinned" and require extrication varies by agency. Most agencies require crews to document the need for extrication in the narrative, but this is not true of all agencies. Agencies also use various terminology to define patients who are pinned and require extrication, with some using abbreviations as well. Further, lack of a defined field also leads to misspellings with manual entry. Having to first define how each agency documents the need for extrication and then searching the narratives creates a major limitation. The authors would recommend NEMSIS adding and defining an element for a pin that requires extrication. Adding this element would enhance the ability for future research involving these patients.

Due to the limitation mentioned above, there is also a limitation on the number of overall incidents. While the three agencies involved have a combined annual call volume greater than 100,000, there were only 985 records meeting the study criteria. One way to increase the overall data pool in the future would be the addition of more agencies or the implementation of the recommendation above.

CONCLUSIONS

The findings in this study demonstrated that the dispatch Key Question "Is anyone pinned (trapped)?" answer is a better predictor for extrication requirement among MVA cases than Semi/Head-on involvement. Each ECC should work directly with their local resources to identify the best response recommendations based on the availability of specialized vehicle extrication resources. This study provides data to assist in making these determinations. Specifically, MVAs involving Semi or HO involvement do not support the EMD overriding the protocol for a couple of reasons: one, the morbidity and mortality of the passengers often does not correlate with the damage of the vehicle, and two, the findings show that the key question "Is anyone pinned (trapped)?" accurately identifies patients requiring extrication when Semi or HO involvement occurs.

The results may support changing the current MPDS determinant code hierarchy to an order that places the pinned (trapped) determinant code (29-D-5) above that of HIGH VELOCITY impact (29-D-3). It is also recommended NEMSIS add and define an element allowing the EMS crew to identify pinned situations requiring extrication. The addition of this element would enhance the ability for future research involving these patients. Further research, with larger sample size collected from diverse regions, is needed to validate these findings.

ACKNOWLEDGEMENTS

The study investigators would like to thank Laura Meyers, Deputy Director, Sedgwick County ECC, Wichita, KS, USA; and Dawn Faudere, Quality Assurance Supervisor, Johnson ECC, KS, USA; for providing approval for data from their agencies to be studied. The same goes to various staff at Butler County ECC and EMS.

REFERENCES

1. National Safety Council. (2018).: Safety on the road. https://www.nsc.org/road-safety. Accessed September 07, 2018.
2. Sasser S, Varghese M, Kellerman A, Lormand JD. (2005). Prehospital Trauma Care Systems. Geneva: World Health Organization.
3. Brown et al. Not All Prehospital Time is Equal: Influence of Scene Time on Mortality. *J Trauma Acute Care Surg.* 2016; 81(1): 93-199.
4. Sasser SM, Hunt RC, Faul M et al. *Morbidity and Mortality Weekly Report: Recommendations and Reports, MMWR.* 2012; 61(1): 1-20
5. Isenberg D, Cone DC, and Vaca FE. Motor Vehicle Intrusion Alone Does Not Predict Trauma Center Admission or Use of Trauma Center Resources. *Prehospital Emergency Care.* 2011; 15(2): 203-207
6. Stuke LE, Duchesne JC, Greiffenstein P et al. Not all mechanisms are created equal: A single-center experience with the national guidelines for field triage of injured patients. *Journal of Trauma and Acute Care Surgery.* 2013; 75(1): 140–145
7. Brown JB, Rosengart MR, Billiar TR et al. Distance Matters: Effect of geographic trauma system resource organization on fatal motor vehicle collisions. *Journal of Trauma and Acute Care Surgery.* 2017; 83(1): 111–118